CLAIMS

[1] A rotation member rotatably or swingably engaging with a housing, the rotation member characterized in that:

a pulsing electric discharge is generated between a molded body molded from a metal powder or a mixture of powders of one or more of metal compounds or ceramics as an electrode or the molded body after being processed with a heat treatment and the rotation member in a processing liquid or a gas, and a coating of the electrode material or any substance combined from the electrode material by energy of the electric discharges is formed on an engaging portion engaging with the housing by means of energy of the electric discharges.

[2] The rotation member recited in claim 1, the rotation member characterized in that:

a groove for pooling a lubrication liquid is formed on the engaging portion.

[3] The rotation member recited in claim 1, the rotation member characterized in that:

the metal powder or the metal compounds or ceramics are Ti, Si, cBN (cubic boron nitride), TiC (titanium carbide), WC (tungsten carbide), SiC (silicon carbide), Cr_3C_2 (chromium carbide), Al_2O_3 (aluminum oxide; alumina), ZrO_2-Y (stabilized zirconium oxide; stabilized zirconia), TiN (titane nitride), TiB (titanium boride), hexagonal BN (boron nitride), MoS_2 (molybdenum disulfide), Cr_2O_3, WS_2 (tungsten disulfide) and $BaZrO_4$ (barium zirconate).

[4] The rotation member recited in claim 2, the rotation member characterized in that:

the metal powder or the metal compounds or ceramics are Ti, Si, cBN (cubic boron nitride), TiC (titanium carbide), WC (tungsten carbide), SiC (silicon carbide), Cr_3C_2 (chromium carbide), Al_2O_3 (aluminum oxide; alumina), ZrO_2-Y (stabilized zirconium oxide; stabilized zirconia), TiN (titane nitride), TiB (titanium boride), hexagonal BN (boron nitride), MoS_2 (molybdenum disulfide), Cr_2O_3,

WS_2 (tungsten disulfide) and $BaZrO_4$ (barium zirconate).

[5] The rotation member recited in claim 1, the rotation member characterized in that:

the coating is formed in the pulsing electric discharge with rotating the rotation member.

[6] The rotation member recited in claim 2, the rotation member characterized in that:

the coating is formed in the pulsing electric discharge with rotating the rotation member.

[7] The rotation member recited in claim 3, the rotation member characterized in that:

the coating is formed in the pulsing electric discharge with rotating the rotation member.

[8] The rotation member recited in claim 4, the rotation member characterized in that:

the coating is formed in the pulsing electric discharge with rotating the rotation member.

[9] A housing with which a rotation member rotatably or swingably engages, the housing characterized in that:

a pulsing electric discharge is generated between a molded body molded from a metal powder or a mixture of powders of one or more of metal compounds or ceramics as an electrode or the molded body after being processed with a heat treatment and the rotation member in a processing liquid or a gas, and a coating of the electrode material or any substance combined from the electrode material by energy of the electric discharges is formed on an engaging portion engaging with the rotation member by means of energy of the electric discharges.

[10] The housing recited in claim 9, the housing characterized in that:

a groove for pooling a lubrication liquid is formed on the

engaging portion.

[11] A bearing for a rotation member rotatably engaging with a housing, the bearing characterized in that:

a pulsing electric discharge is generated between a molded body molded from a metal powder or a mixture of powders of one or more of metal compounds or ceramics as an electrode or the molded body after being processed with a heat treatment and the rotation member in a processing liquid or a gas, and a coating of the electrode material or any substance combined from the electrode material by energy of the electric discharges is formed on at least one of an engaging portion engaging with the housing and a engagement subject portion of the housing having a slightly larger inner diameter than an outer diameter of the engaging portion and engaged with the engaging portion.

[12] The bearing for the rotation member recited in claim 11, the bearing for the rotation member characterized in that:

a groove for pooling a lubrication liquid is formed on at least one of the engaging portion and the engagement subject portion.

[13] A gear box driven by a turbine shaft of a gas turbine, the gear box assembly characterized in that:

the gear box assembly has a housing supported by an engine casing of the gas turbine at the exterior of the engine casing and;

a rotation member provided with an engaging portion engaging with a engagement subject portion of the housing and provided to engage with the housing by the engaging portion so as to be rotatable relative to the housing in the interior of the housing,

wherein an inner diameter of the engagement subject portion is formed slightly larger than an outer diameter of the engaging portion, and further a pulsing electric discharge is generated between a molded body molded from a metal powder or a mixture of powders of one or more of metal compounds or ceramics as an electrode or the molded body after being processed with a heat treatment

and the rotation member in a processing liquid or a gas, and a coating of the electrode material or any substance combined from the electrode material by energy of the electric discharges is formed on the engaging portion of the rotation member by means of energy of the electric discharges, and a groove for pooling a lubrication liquid is formed on the engagement subject portion of the housing.

[14] A rotating machine in which a rotation member is provided to be rotatable in a casing with interposing a roller bearing, the rotating machine characterized in that:

a coating is formed at a portion of the rotation member engaging with the roller bearing and the coating is composed of an electrode material or any substance combined from an electrode material by energy of electric discharges where the electric discharges are pulsingly generated between a molded body molded from a metal powder or a mixture of powders of one or more of metal compounds or ceramics as an electrode or the molded body after being processed with a heat treatment in a processing liquid or a gas.

[15] A shaft structure for variable vanes for regulating a fluid, characterized by being integrally provided with a coating layer including ceramics having anti-abrasiveness or ceramics and a solid lubricant having lubricity on a peripheral surface of a shaft portion provided in the variable vanes for regulating the fluid.

[16] The shaft structure for variable vanes for regulating a fluid recited in claim 15, the shaft structure for the variable vanes for regulating the fluid characterized in that the ceramics are ceramics including one or more of cBN, TiC, WC, SiC, Cr_3C_2, Al_2O_3, ZrO_2-Y, TiN, TiB, and the solid lubricant is a lubricant including one or more of hexagonal BN, MoS_2, Cr_2O_3, WS_2 and $BaZrO_4$.

[17] The shaft structure for variable vanes for regulating a fluid recited in claim 15, the shaft structure for the variable vanes for regulating the fluid characterized in that the variable vanes

for regulating the fluid is variable stator vanes provided in a compressor and/or a turbine in a gas turbine engine or a supercharger.

[18] The shaft structure for variable vanes for regulating a fluid recited in claim 16, the shaft structure for the variable vanes for regulating the fluid characterized in that the variable vanes for regulating the fluid is variable stator vanes provided in a compressor and/or a turbine in a gas turbine engine or a supercharger.

[19] A method for surface treatment of a shaft of variable vanes for regulating a fluid characterized by generating a pulsing electric discharge between an electrode including ceramics such as cBN, TiC, WC, SiC, Cr_3C_2, Al_2O_3, ZrO_2-Y, TiN and TiB or containing these ceramics and a solid lubricant such as hexagonal BN, MoS_2, Cr_2O_3, WS_2 and $BaZrO_4$ and a shaft portion of the variable vanes for regulating the fluid, and forming a coating layer composed of electrode constituents or compounds combined in an electric discharge atmosphere having anti-abrasiveness and lubricity on a surface of the shaft portion.

[20] The method for surface treatment recited in claim 19, the method for surface treatment characterized in that:

the coating layer is formed with rotating the shaft of the variable vanes for regulating the fluid.